Management Report

SECONDARY SUCCESSION IN THE SPRUCE-FIR FOREST

OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK

MANAGEMENT REPORT NO. 7

1976

George S. Ramseur
Department of Biology
The University of the South
Sewanee, Tennessee

NATIONAL PARK SERVICE

SOUTHEAST REGIONAL

UPLANDS FIELD RESEARCH LABORATORY

GREAT SMOKY MOUNTAINS

NATIONAL PARK

D-256

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This project was begun in order to discover the rate of secondary succession. Current vegetation was analysed to establish the rate of past growth and invasion. These data were used to extrapolate into the future to establish a probable time when the climax vegetation would be re-established.

Early in this study it became apparent that the study plots of previous workers in the park would be impossible to relocate with certainty. In order for this study to be useful in the future the study areas were established with fixed permanent landmarks as reference points. Individual trees were then located by azimuth and distance from the reference points.

The data are presented in the form of computer printouts and computer plotted tree maps. The main interpretation is in the form of graphs. When the decision was made to file the information in the computer, it was hoped that extensive conclusions could be reached. Numerous attempts at correlations (comparisons of age to height, spread, DBH, etc.) were made. The great variation within the sample has made it impossible for me to interpret these data. I plan to attempt other analyses in the future and will report any success as an appendage to this report.

STUDY AREAS---See Map 1

I. Andrews Bald: The study plot is 135 x 90 meters with the eastern boundary approximately along the trail from Clingmans Dome. The northeast corner is near the forest border and is 85 meters north (AZ 4°) from the sign post. The sign post, which may be considered less than a permanent marker is 62° and 4.3 meters from a rock with a distinctive natural formation, a raised circle with a slit in the center. From the sign post the reference points are located as follows.

RP 1: 260°, 20 m.

RP 2: 261°, 51.5 m.

RP 3: 291.5°, 21.5 m.

RP 4: 315°, 55 m.

II. Mt. Buckley: The study plot is located within a burn scar of a 1925 fire. The first reference point is a sharp rock about 1 meter tall located about 2 meters south of the Appalachian Trail at a point 261.3 meters west of the peak of Mt. Buckley (a sharp rock by an old stump). Reference point 1 is 52 meters from the edge of the forest.

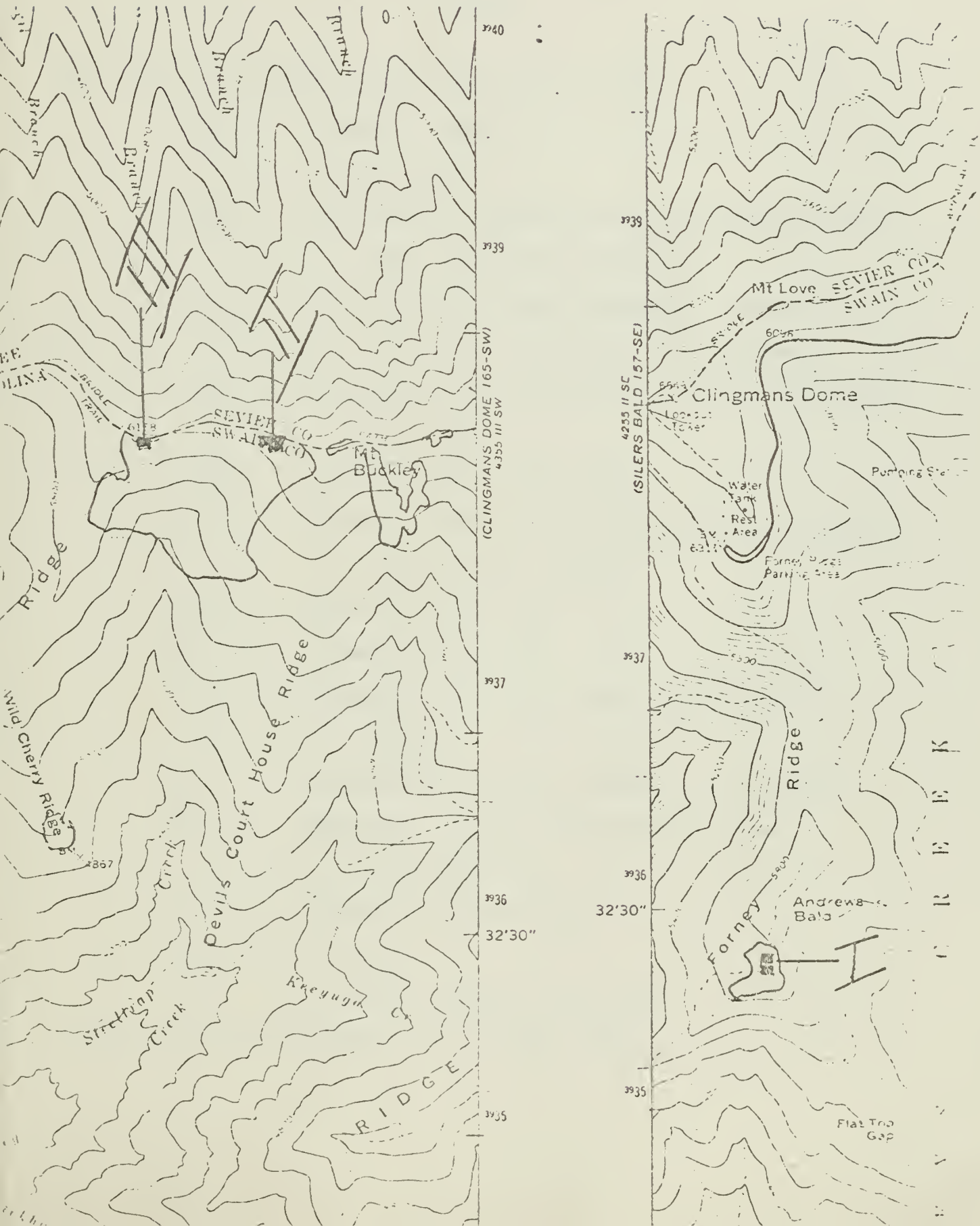
Reference point 2 is a large sloping rock about 2 meters south of the Appalachian Trail, 291° and 83.3 meters from reference point 1.

Reference point 3 is tree #3 (computer No. 52) which is 148 and 12.5 meters from Reference point 2.

III. Loggy: This study area is near the main ridge about .2 mile east of Loggy Ridge in the same fire scar as Area II. The single Reference Point is a rock .8 meter tall and 1.25

meters long with a horizontal crack located just south of an overlook of the Appalachian Trail.

MAP 1. LOCATION OF STUDY AREAS



TABLES

The Column headings are interpreted as follows:

T/L	Computer number
#	field number
AGE	Age as determined by reading increment core under dissecting microscope
F_2	reliability of age reading as determined by condition of the core (4 is highest)
CAB	Circumference of the tree at point of increment core
CBH	Circumference at $4\frac{1}{2}$ feet
HT	Height in meters (estimated using a reference pole of known length)
SPR	Radius of drip line
CR	Length of the core
CR_1	Length of the core minus length of last 5 rings
F	reliability of core radius (4 is highest)
SP	Species: 1-fir; 2-spruce;3-mtn. ash; 4-fire cherry
R.P.	Reference Point number
AZ	Azimuth
D	Distance (meters) from R.P.

A value of -1 was assigned to a missing datum.

TABLE 1 ANDREWS BALD

T/L #	AGE	F2	CAB	CBH	HT	SPR	CR	CR1	F1	SP	RP	AZ	D
(1) 22	34	1	-1.000	0.953	7.62	2.13	0.112	0.097	2	1	1	228.0	13.4
(2) 23	17	4	0.406	0.330	4.88	1.62	0.051	0.035	4	1	1	354.0	19.8
(3) 24	25	4	1.041	0.914	8.53	3.20	0.185	0.155	4	1	1	310.0	20.1
(4) 25	36	1	-1.000	1.118	7.62	2.13	0.193	0.160	1	1	1	227.0	13.4
(5) 26	20	4	0.635	0.508	6.40	1.62	0.109	0.086	4	1	1	354.0	20.1
(6) 27	20	4	0.762	0.584	6.10	1.52	0.089	0.061	4	1	1	226.0	19.9
(7) 28	19	3	1.016	0.787	8.84	2.44	0.150	0.120	2	1	1	90.0	2.9
(8) 29	23	4	1.003	0.648	6.10	1.98	0.117	0.081	4	2	2	270.0	10.1
(9) 30	14	3	0.610	0.559	5.49	2.13	0.074	0.058	4	1	2	212.0	16.5
(10) 31	29	4	0.737	0.660	10.06	1.52	0.112	0.092	4	1	2	183.0	26.5
(11) 32	29	3	0.381	0.343	7.01	1.07	0.064	0.054	4	1	2	182.5	26.5
(12) 33	30	4	0.673	0.584	8.84	0.91	0.084	0.073	4	1	2	183.5	26.5
(13) 34	29	3	0.533	0.495	8.23	0.99	0.081	0.069	4	2	2	185.0	27.4
(14) 35	21	4	0.229	0.211	3.96	0.30	0.030	0.025	4	1	2	184.0	28.7
(15) 36	34	4	1.016	0.914	-1.00	1.95	0.130	0.115	4	1	2	184.0	29.6
(16) 37	17	3	0.254	0.191	-1.00	-1.00	0.028	0.025	4	1	2	182.0	30.8
(17) 38	18	3	0.813	0.711	-1.00	-1.00	0.081	0.053	4	1	2	179.0	30.2
(18) 40	29	4	0.762	0.699	-1.00	-1.00	0.114	0.095	4	1	2	181.0	27.4
(19) 41	12	4	0.203	0.102	2.19	0.61	0.018	0.007	4	1	2	156.0	19.8
(20) 42	19	3	1.219	0.889	9.14	2.74	0.112	0.098	4	1	2	194.0	32.9
(21) 44	29	3	1.486	1.270	8.99	2.74	0.165	0.143	4	2	3	20.0	22.1
(22) 45	11	4	0.279	0.203	4.27	1.07	0.036	0.017	4	1	3	22.0	18.8
(23) 46	6	4	0.178	0.140	2.99	0.43	0.020	0.001	4	1	3	28.0	18.4
(24) 47	14	4	0.419	0.356	6.10	1.52	0.056	0.034	4	1	3	15.0	25.1
(25) 48	15	4	0.406	0.330	5.49	0.61	0.046	0.025	4	1	3	25.0	26.7
(26) 50	10	4	0.254	0.173	3.66	0.91	0.030	0.008	4	1	3	24.0	26.4
(27) 53	19	4	0.457	0.457	6.10	1.65	0.064	0.041	4	2	3	45.0	22.9
(28) 54	18	3	0.533	0.432	6.10	1.65	0.069	0.049	4	2	3	46.0	22.7
(29) 55	11	3	0.279	0.229	4.88	1.22	0.036	0.028	4	1	3	360.0	29.1
(30) 56	28	4	0.737	0.622	6.71	2.82	0.117	0.092	4	1	3	349.0	25.8
(31) 57	26	3	0.965	0.737	9.14	3.35	0.178	0.080	4	1	3	351.0	26.5
(32) 58	27	3	0.991	1.016	9.14	2.59	0.119	0.101	4	1	3	347.0	27.9
(33) 61	18	3	0.254	0.241	-1.00	-1.00	0.036	0.026	4	1	3	349.0	30.9
(34) 62	18	3	0.508	0.343	4.88	0.87	0.084	0.051	4	1	3	349.0	31.3
(35) 63	21	4	0.495	0.330	5.18	1.45	0.071	0.043	4	1	3	351.0	26.5
(36) 65	13	4	0.058	0.056	7.92	3.05	0.069	0.041	4	1	4	16.0	17.0
(37) 66	19	3	0.089	0.081	7.62	3.35	0.150	0.113	3	1	4	2.0	18.4
(38) 67	18	3	0.584	0.406	6.40	1.37	0.069	0.050	4	1	4	357.0	17.4
(39) 68	25	3	1.448	0.991	10.06	3.51	0.208	0.172	4	1	4	8.0	39.4
(40) 69	25	3	1.473	1.270	7.01	4.11	0.203	0.168	3	2	4	359.0	33.9

(41)	70	13	4	0.381	0.203	4.05	1.45	0.048	0.022	4	2	4	1.0	28.4
(42)	71	15	4	0.432	0.356	5.79	2.13	0.056	0.036	4	2	4	350.0	32.4
(43)	72	15	3	0.737	0.546	7.62	2.44	0.114	0.085	4	1	4	336.0	30.0
(44)	73	33	3	0.610	0.508	9.14	3.20	0.071	0.059	3	1	4	322.0	27.6
(45)	74	18	3	0.737	0.495	7.92	2.44	0.119	0.089	4	1	4	294.0	25.6
(46)	75	30	3	0.124	1.092	9.45	3.66	0.234	0.199	4	2	4	280.0	38.6
(47)	76	22	4	0.610	0.457	7.62	2.06	0.086	0.056	4	1	4	276.0	31.2
(48)	77	20	4	0.254	0.368	5.79	1.68	0.069	0.036	4	1	4	273.0	21.1
(49)	78	16	4	0.406	0.305	6.10	1.52	0.056	0.041	4	2	4	283.0	27.7
(50)	79	26	4	0.483	0.356	6.10	1.68	0.097	0.050	4	2	4	272.0	32.9
(51)	80	20	4	0.457	0.330	5.79	1.83	0.114	0.081	4	1	4	273.0	37.2
(52)	81	11	3	0.229	0.127	3.05	1.07	0.030	0.009	4	1	4	270.0	37.6
(53)	82	17	4	0.457	0.330	6.10	1.83	0.053	0.036	4	1	4	283.0	36.3
(54)	83	8	3	0.356	0.292	5.18	1.52	0.046	0.025	4	1	4	284.0	40.5
(55)	84	10	4	0.152	0.097	2.74	0.76	0.018	0.004	4	1	4	281.0	34.1

TABLE 2 MT. BUCKLEY

T/L	#	AGE	F2	CAB	CBH	HT	SPR	CR	CR1	F1	SP	RP	AZ	D
(1)	1	39	3	0.546	0.330	5.49	2.44	0.092	-1.000	3	3	1	219.0	17.7
(2)	2	18	4	0.305	0.229	3.96	1.22	0.043	-1.000	4	3	1	254.0	21.6
(3)	3	18	2	-1.000	-1.000	-1.00	-1.00	0.033	-1.000	2	3	1	254.0	8.4
(4)	4	48	4	0.191	0.114	2.29	1.00	0.023	-1.000	4	3	1	265.0	15.0
(5)	5	13	3	-1.000	-1.000	-1.00	-1.00	0.024	-1.000	4	3	1	265.0	15.6
(6)	6	20	4	0.216	0.127	2.44	1.22	0.033	-1.000	4	3	1	129.0	11.0
(7)	7	17	4	0.229	0.165	1.83	1.44	0.030	-1.000	4	3	1	120.0	9.2
(8)	8	16	3	0.483	0.337	4.57	1.52	0.048	-1.000	3	1	1	322.0	9.1
(9)	9	15	4	0.686	0.533	6.10	1.83	0.102	-1.000	4	1	1	327.0	10.6
(10)	10	14	4	0.533	0.419	6.10	-1.00	0.079	-1.000	4	1	1	268.0	16.8
(11)	11	29	3	0.762	0.673	6.71	2.40	0.108	-1.000	4	1	1	263.0	22.0
(12)	12	35	3	0.654	0.559	5.79	1.98	0.099	-1.000	4	2	1	262.0	23.4
(13)	13	34	2	0.965	0.787	7.01	2.89	0.160	-1.000	2	1	1	254.0	26.8
(14)	14	22	4	0.495	0.394	4.88	1.37	0.066	-1.000	4	2	1	303.0	23.0
(15)	15	12	2	0.419	0.279	3.96	1.29	0.069	-1.000	2	1	1	334.0	18.6
(16)	16	28	3	1.029	0.826	7.62	3.20	0.123	-1.000	4	1	1	326.2	24.3
(17)	17	20	4	0.292	0.203	3.35	0.91	0.033	-1.000	4	2	1	219.0	15.0
(18)	18	27	3	0.762	0.635	7.92	2.13	0.104	-1.000	4	1	1	221.0	21.9
(19)	19	21	2	0.940	0.749	7.62	2.44	0.130	-1.000	2	1	1	145.0	15.9
(20)	20	22	1	0.991	0.762	6.10	3.05	0.140	-1.000	1	1	1	143.0	22.5
(21)	21	21	2	0.787	0.610	5.79	2.44	0.132	-1.000	2	1	1	120.0	12.4
(22)	1	22	3	0.788	0.470	4.00	0.45	0.115	-1.000	4	2	2	80.0	1.5
(23)	2	13	2	0.100	0.010	1.50	-1.00	0.012	-1.000	3	4	2	-1.0	-1.0
(24)	3	16	2	0.130	0.080	2.78	1.85	0.020	-1.000	3	4	2	110.0	8.3
(25)	4	20	4	0.160	0.080	2.50	1.00	0.023	-1.000	4	4	2	116.0	6.0
(26)	5	12	4	0.250	0.800	3.45	1.22	0.041	-1.000	4	1	2	118.0	14.3
(27)	6	13	4	0.220	0.200	4.50	1.25	0.029	-1.000	4	1	2	129.0	9.0
(28)	7	12	4	0.350	0.170	4.00	1.10	0.051	-1.000	4	1	2	122.0	5.9
(29)	8	14	4	0.390	0.270	10.00	1.80	0.053	-1.000	4	1	2	138.0	6.7
(30)	9	18	4	0.150	0.040	2.00	1.00	0.025	-1.000	4	3	2	84.0	2.9
(31)	10	30	3	1.170	1.060	6.00	4.40	0.105	-1.000	4	1	2	137.0	12.4
(32)	11	15	3	0.420	0.260	4.30	1.90	0.052	-1.000	4	2	2	131.0	14.0
(33)	12	15	4	0.470	0.350	5.00	1.85	0.077	-1.000	4	1	2	133.0	18.1
(34)	13	32	4	0.600	0.530	7.00	2.20	0.072	-1.000	4	1	2	133.0	20.8
(35)	14	12	3	0.900	-1.000	1.27	0.40	0.014	-1.000	4	1	2	135.0	22.0
(36)	15	14	4	0.180	0.150	3.20	1.00	0.027	-1.000	4	1	2	128.0	19.0
(37)	16	12	4	0.100	0.050	2.10	0.45	0.018	-1.000	4	1	2	127.0	18.6
(38)	17	16	4	0.210	0.140	3.60	1.20	0.028	-1.000	4	1	2	123.0	18.4
(39)	18	12	4	0.120	0.100	2.45	0.72	0.019	-1.000	4	1	2	120.0	17.7
(40)	19	-1	-1	0.600	-1.000	1.10	-1.00	-1.000	-1.000	-1	1	2	-1.0	-1.0

(41)	20	12	4	0.200	0.120	2.70	0.90	0.031	-1.000	4	1	2	124.0	19.4
(42)	21	9	4	0.160	0.080	2.40	-1.00	0.020	-1.000	4	1	2	-1.0	-1.0
(43)	22	16	4	0.160	0.080	2.00	-1.00	0.019	-1.000	4	1	2	-1.0	-1.0
(44)	23	22	4	0.540	0.310	5.00	2.50	0.068	-1.000	4	2	2	129.0	23.7
(45)	24	21	3	0.560	0.550	5.20	-1.00	0.061	-1.000	4	1	2	-1.0	-1.0
(46)	25	15	4	0.170	0.080	2.30	-1.00	0.019	-1.000	4	1	2	-1.0	-1.0
(47)	26	10	4	2.500	1.750	3.50	0.90	0.040	-1.000	4	1	2	131.0	25.0
(48)	27	14	4	0.190	0.100	2.55	0.80	0.023	-1.000	4	2	2	133.0	27.0
(49)	28	-1	-1	-1.000	-1.000	0.93	0.41	-1.000	-1.000	-1	1	2	132.0	25.4
(50)	1	10	3	0.230	0.170	3.50	1.05	0.036	-1.000	4	1	2	143.0	9.4
(51)	2	25	4	0.210	0.180	3.80	1.22	0.024	-1.000	4	1	2	144.0	13.8
(52)	3	29	3	1.080	0.900	9.00	2.80	0.150	-1.000	3	1	2	148.0	12.5
(53)	4	25	4	0.180	0.170	5.00	1.25	0.027	-1.000	4	1	2	154.0	13.6
(54)	5	8	3	0.200	0.120	4.00	0.80	0.027	-1.000	3	1	2	153.0	8.4
(55)	6	24	3	0.570	0.480	8.50	1.00	0.077	-1.000	4	1	2	154.0	13.4
(56)	7	25	3	0.770	0.620	10.00	1.25	0.087	-1.000	4	1	2	158.0	16.2
(57)	8	27	3	0.280	0.220	5.50	0.25	0.035	-1.000	4	2	2	158.0	15.2
(58)	9	46	3	0.780	0.680	8.00	0.50	0.090	-1.000	4	2	2	158.0	14.8
(59)	10	31	4	0.380	0.420	8.00	0.50	0.040	-1.000	4	2	2	160.0	16.5
(60)	11	-1	-1	-1.000	-1.000	-1.00	-1.00	-1.000	-1.000	-1	-1	2	-1.0	-1.0
(61)	12	36	4	0.710	0.570	7.00	1.50	0.089	-1.000	4	2	2	162.0	13.0
(62)	13	21	4	0.050	0.050	2.30	0.50	0.013	-1.000	4	1	2	153.0	12.9
(63)	14	15	4	0.260	0.200	4.50	1.60	0.056	-1.000	4	1	2	173.0	11.5
(64)	15	17	4	0.330	0.290	5.00	1.15	0.045	-1.000	4	1	2	175.0	12.8
(65)	16	12	4	0.350	0.280	5.00	1.00	0.048	-1.000	4	1	2	178.0	10.7
(66)	17	32	4	0.810	0.590	7.90	1.50	0.089	-1.000	4	2	3	235.0	4.2
(67)	18	35	4	0.480	0.420	7.40	1.20	0.074	-1.000	4	2	3	224.0	4.2
(68)	19	28	3	0.610	0.500	7.40	1.90	0.086	-1.000	2	2	3	215.0	6.0
(69)	20	33	2	0.830	0.600	6.90	2.00	0.130	-1.000	2	2	3	205.0	6.8
(70)	21	22	4	0.130	0.090	2.50	0.80	0.025	-1.000	4	1	3	203.0	6.7
(71)	22	14	3	0.180	0.120	2.60	0.80	0.024	-1.000	4	1	3	211.0	7.5
(72)	23	18	3	0.170	0.140	5.00	0.80	0.020	-1.000	3	1	3	212.0	7.9
(73)	24	30	2	0.600	0.470	6.10	1.70	0.073	-1.000	2	2	3	222.0	7.4
(74)	25	32	4	0.720	0.550	6.10	2.00	0.089	-1.000	4	2	3	226.0	8.4
(75)	26	23	4	0.250	0.200	5.50	1.30	0.025	-1.000	4	4	3	231.0	8.1

ABLE 3 LOGGY

T/L	#	AGE	F2	CAB	CRH	HT	SPR	CR	CR1	F1	SP	RP	AZ	D
1)	1	88	4	0.810	0.770	5.50	2.30	9.100	-1.000	4	1	1	278.0	7.3
2)	2	42	3	0.270	0.220	3.00	1.80	3.450	-1.000	4	3	1	-1.0	7.6
3)	3	50	3	0.760	0.630	6.00	2.60	8.400	-1.000	3	2	1	-1.0	12.9
4)	4	42	3	0.680	0.600	7.00	1.75	6.800	-1.000	4	1	1	-1.0	-1.0
5)	5	68	2	1.350	1.140	12.00	2.50	15.100	-1.000	2	1	1	-1.0	17.3
6)	6	31	2	0.920	0.720	7.50	1.85	11.300	-1.000	3	1	1	238.0	14.6
7)	7	41	4	0.270	0.200	3.50	0.50	8.200	-1.000	4	1	1	235.0	14.9
8)	8	21	4	0.370	0.300	4.80	1.35	4.400	-1.000	4	1	1	233.0	19.9
9)	9	23	3	0.370	0.320	4.10	1.10	4.900	-1.000	4	1	1	227.0	12.2
10)	10	45	3	0.620	0.390	4.50	1.80	6.100	-1.000	4	2	1	216.0	13.6
11)	11	21	4	0.120	0.040	1.55	0.61	1.250	-1.000	4	2	1	214.0	13.4
12)	12	11	4	0.100	0.090	3.20	1.34	0.900	-1.000	4	3	1	214.0	17.3
13)	13	14	4	0.170	0.120	3.90	1.29	2.400	-1.000	4	3	1	211.0	19.2
14)	14	25	3	0.290	0.250	4.20	2.23	2.700	-1.000	4	3	1	198.0	8.9
15)	15	20	4	0.160	0.130	3.00	1.90	2.300	-1.000	4	3	1	196.0	19.2
16)	16	28	2	0.260	0.180	2.90	0.45	3.400	-1.000	2	1	1	195.0	8.1
17)	17	38	3	0.240	0.160	4.00	1.95	2.900	-1.000	3	3	1	191.0	15.2
18)	18	16	3	0.260	0.150	3.10	0.80	3.900	-1.000	3	2	1	188.0	7.9
19)	19	-1	-1	0.240	0.160	2.77	1.05	-1.000	-1.000	-1	3	1	186.0	7.0
20)	20	30	3	0.410	0.270	4.50	1.90	4.400	-1.000	3	3	1	178.0	17.5
21)	21	13	4	0.220	0.110	2.80	1.25	1.500	-1.000	4	3	1	170.0	10.2
22)	22	21	4	0.210	0.160	3.90	1.94	2.300	-1.000	4	3	1	168.0	12.9
23)	23	9	4	0.150	0.060	2.43	0.55	1.400	-1.000	4	3	1	166.0	15.8
24)	24	30	3	0.550	0.440	5.50	2.00	4.500	-1.000	4	1	1	163.0	23.9
25)	25	18	4	0.170	0.160	3.30	1.85	2.350	-1.000	4	3	1	152.0	22.8
26)	26	35	3	0.710	0.630	8.00	2.13	9.200	-1.000	4	1	1	142.0	12.3
27)	27	22	3	0.220	0.160	3.10	1.53	2.650	-1.000	4	3	1	130.0	24.3
28)	28	23	3	0.240	0.190	3.50	2.68	3.400	-1.000	4	3	1	92.0	25.0
29)	29	14	4	0.130	0.100	2.25	0.85	1.360	-1.000	4	4	1	151.0	25.3

TIM
CONSOLE TIME = 34 MINUTES. TOTAL TIME = 5044 MINUTES.

TREE MAPS

From the field data filed in the computer, TREE MAPS were plotted on a H-P 5202A GRAPHIC PLOTTER. The originals are color coded to species and are drawn to scale from the SPR data. There is some distortion in the xerox copies.

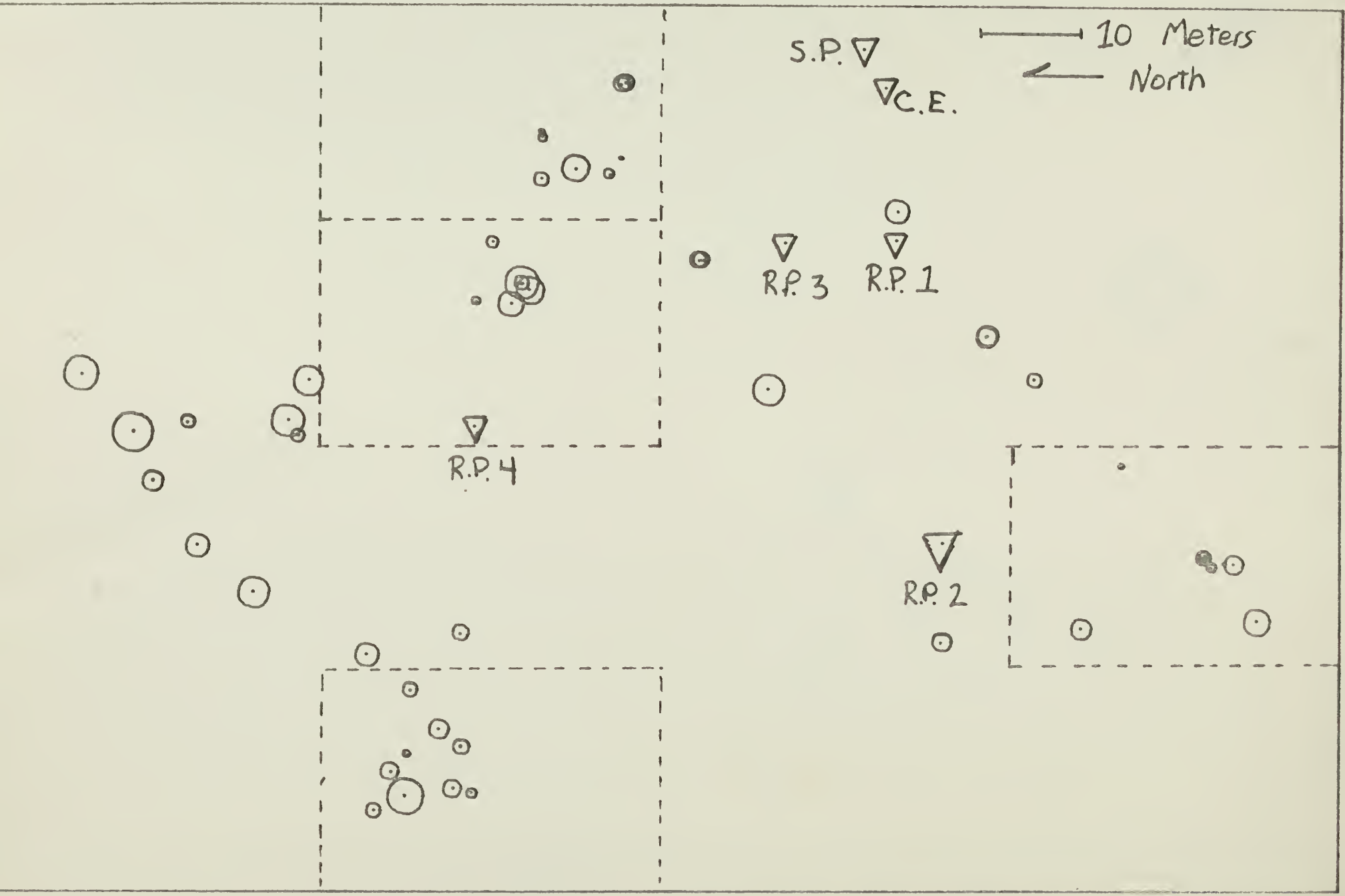
Species are identified on non-color maps by:

1. Fir..... Black
2. Spruce..... Red
3. Mountain Ash..... Blue
4. Fire Cherry..... Green

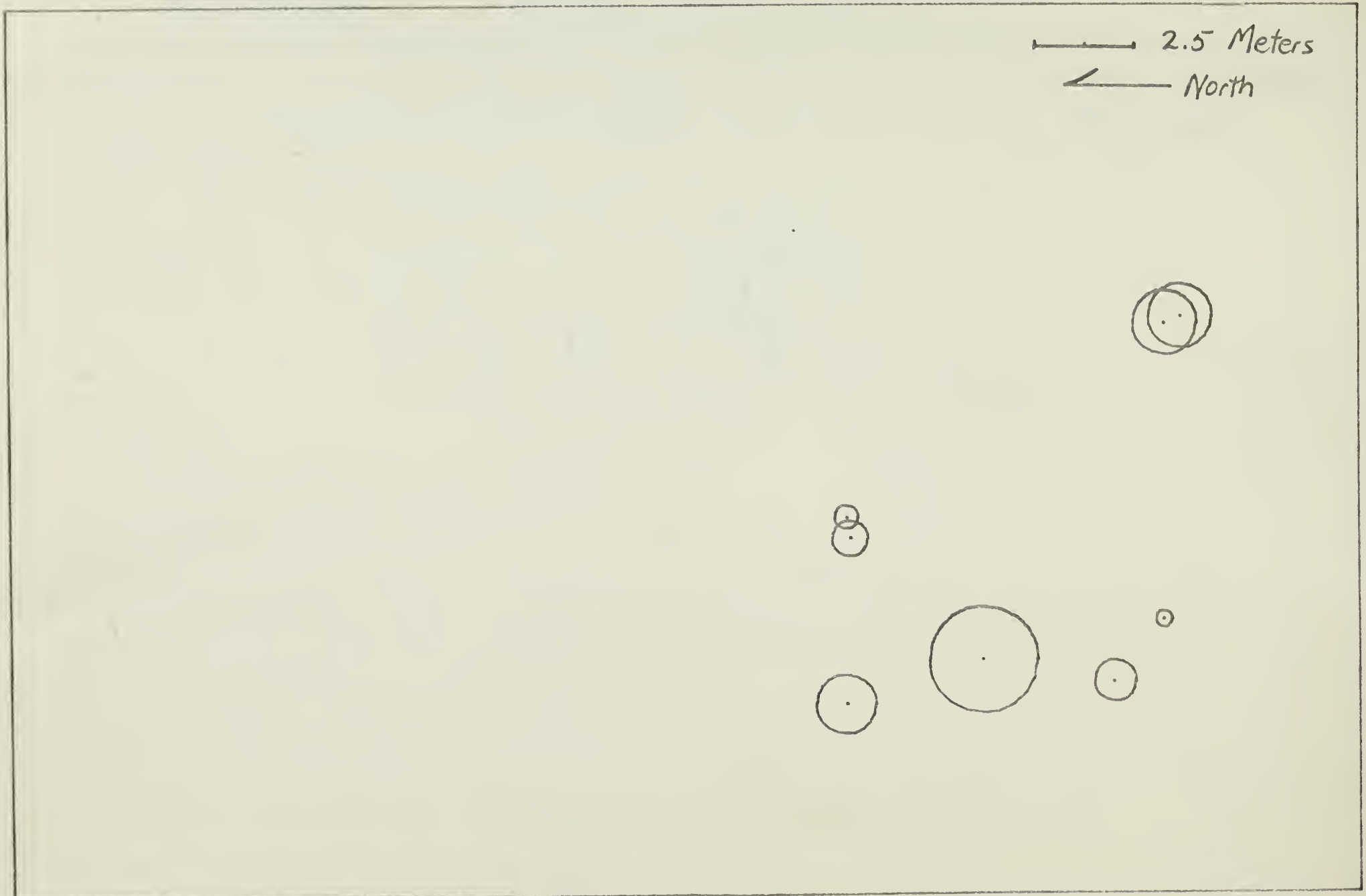
TREE MAP 1. Andrews Bald

Boundary is 135 x 90 Meters

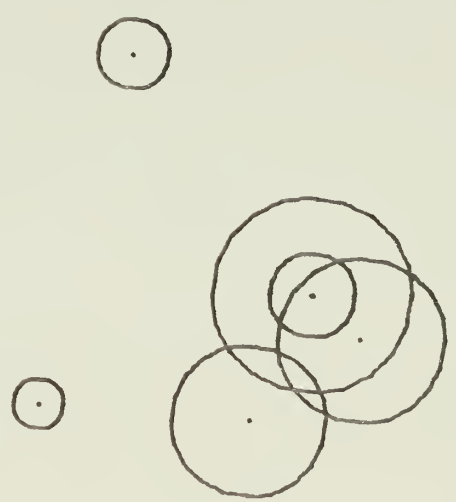
Broken lines show inset maps (1A–1D)



TREE MAP 1A. Boundary is 33.13 x 22.13 Meters



TREE MAP 1B. Boundary is 33.75 x 22.75 Meters

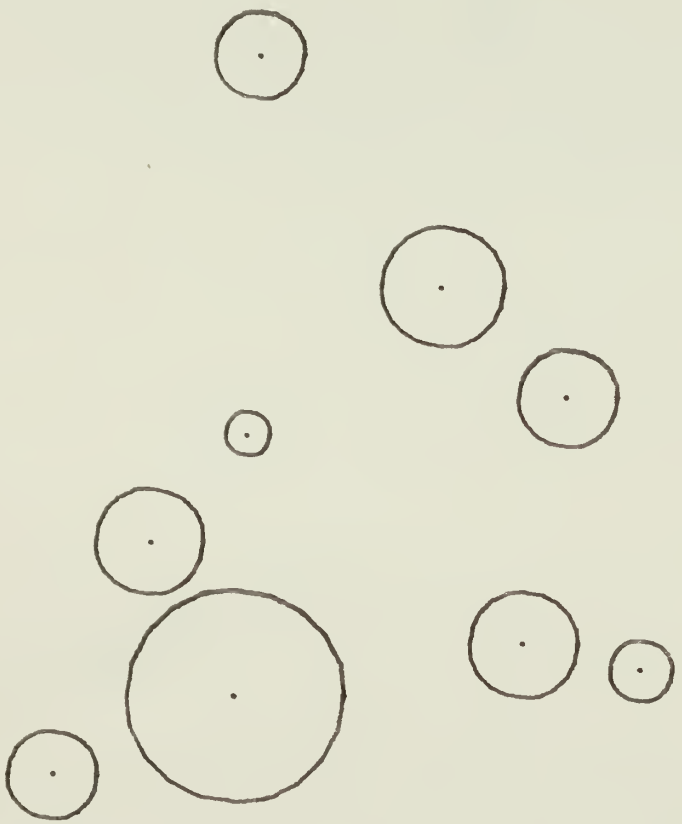


2.5 Meters

North

R.P. 4

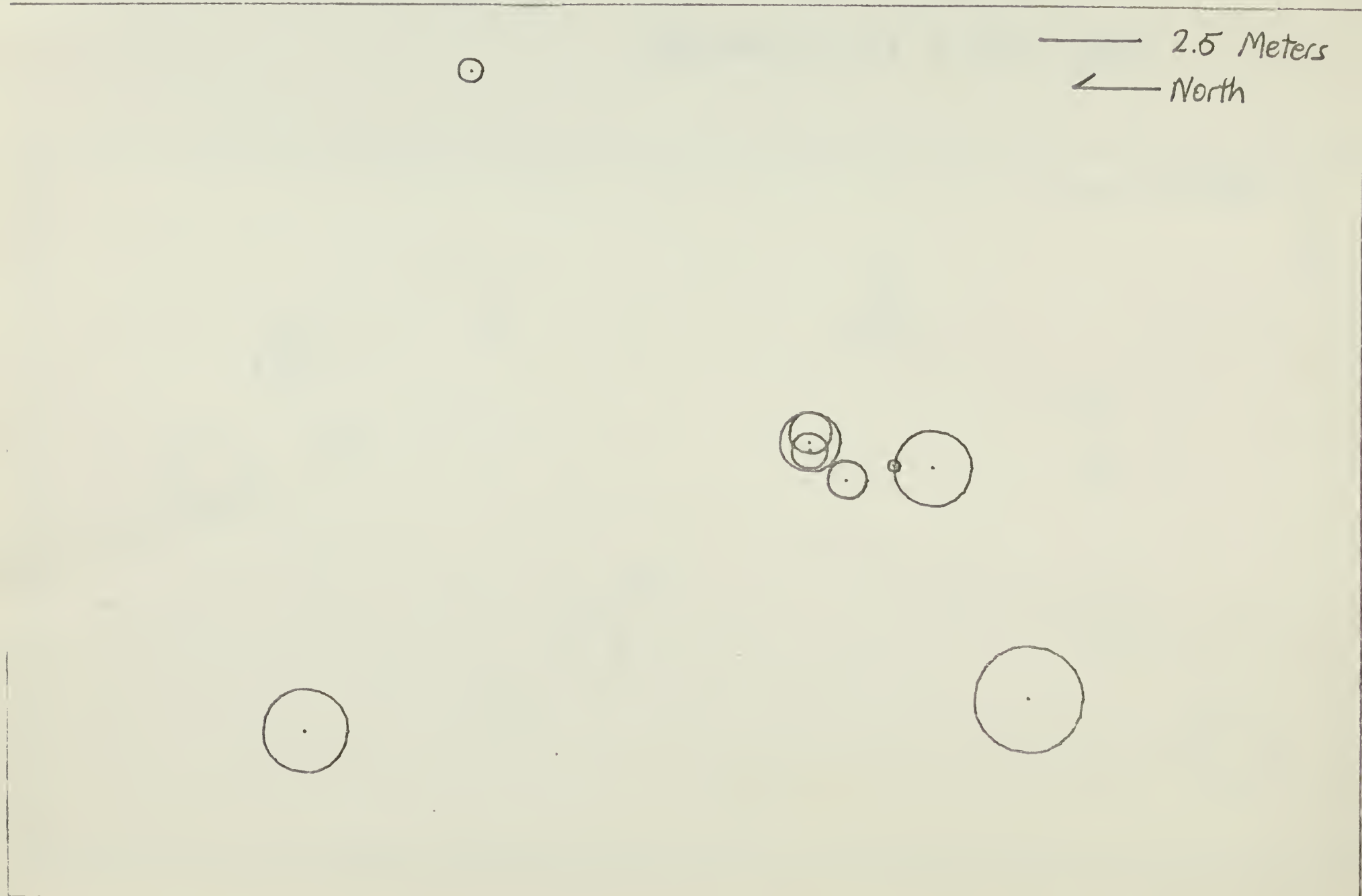
TREE MAP 1C. Boundry is 33.75 x 22.75 Meters



2.5 Meters

North

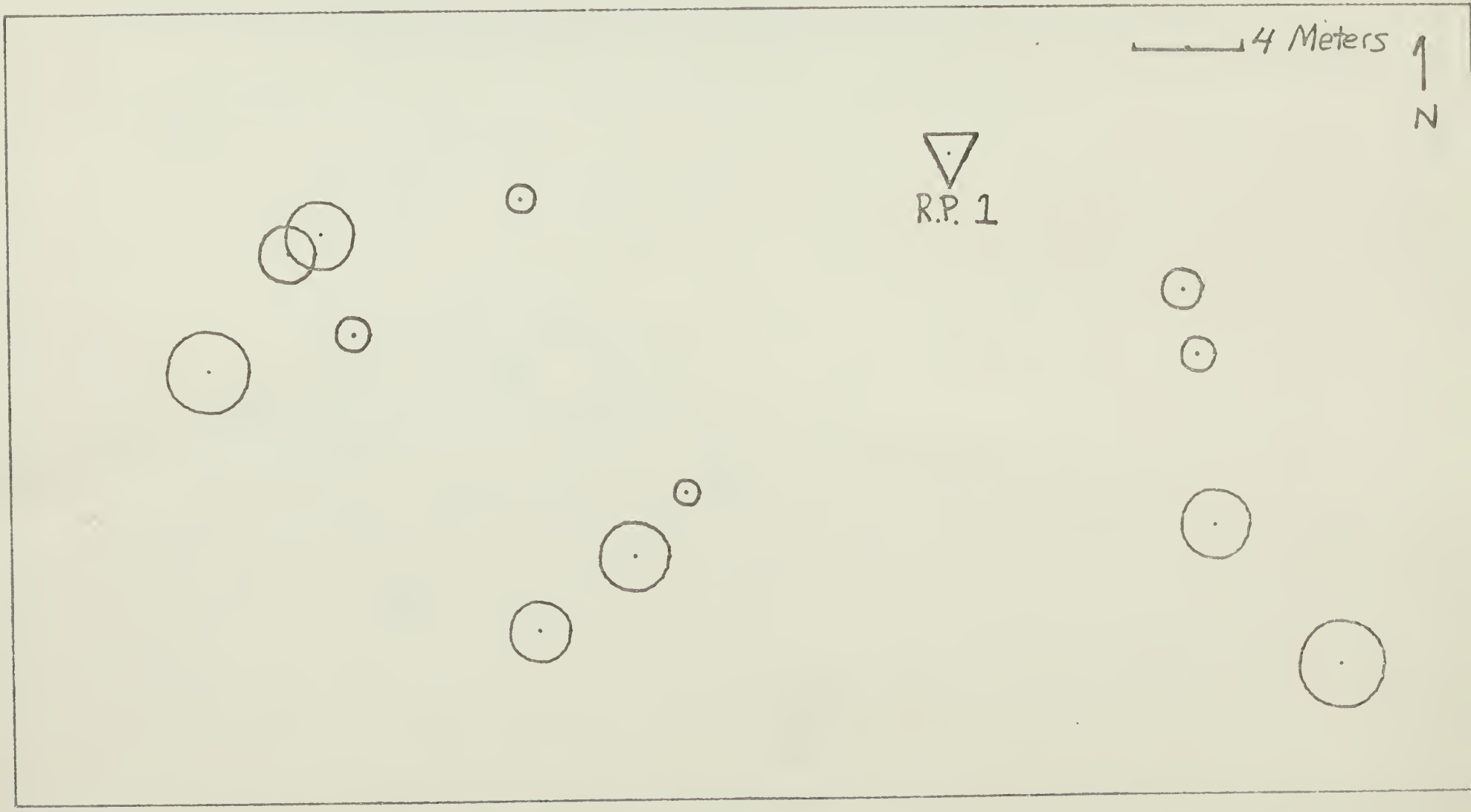
TREE MAP 1D. Boundary is 33.75 x 22.75 Meters



TREE MAP 2S. Mt. Buckley

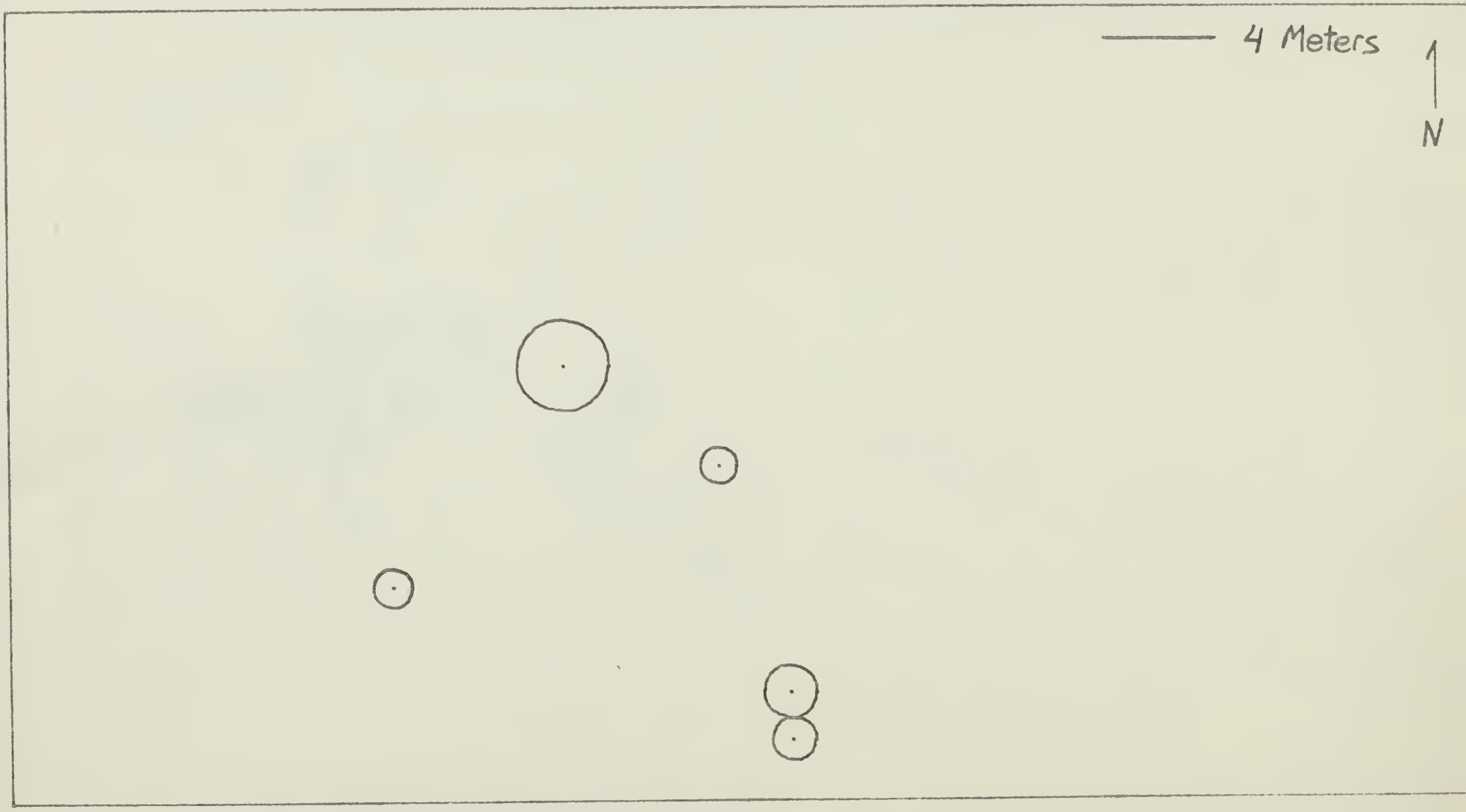
Southern half of Reference Pt. 1

Boundary is 51 x 27.5 Meters



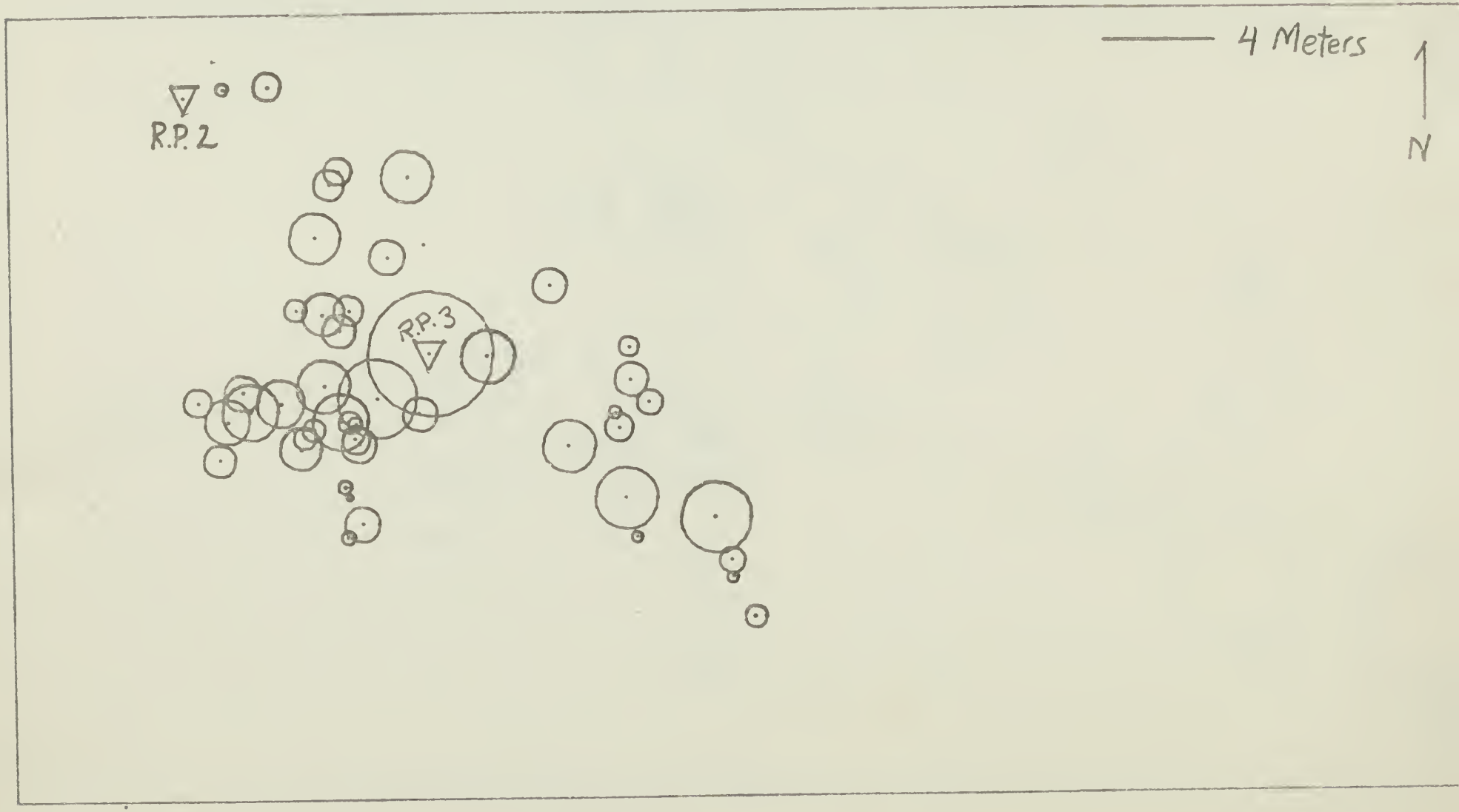
TREE MAP 2N. Mt. Buckley Northern half of Reference Pt. 1

Boundary is 51 x 27.5 Meters



TREE MAP 3. Mt. Buckley

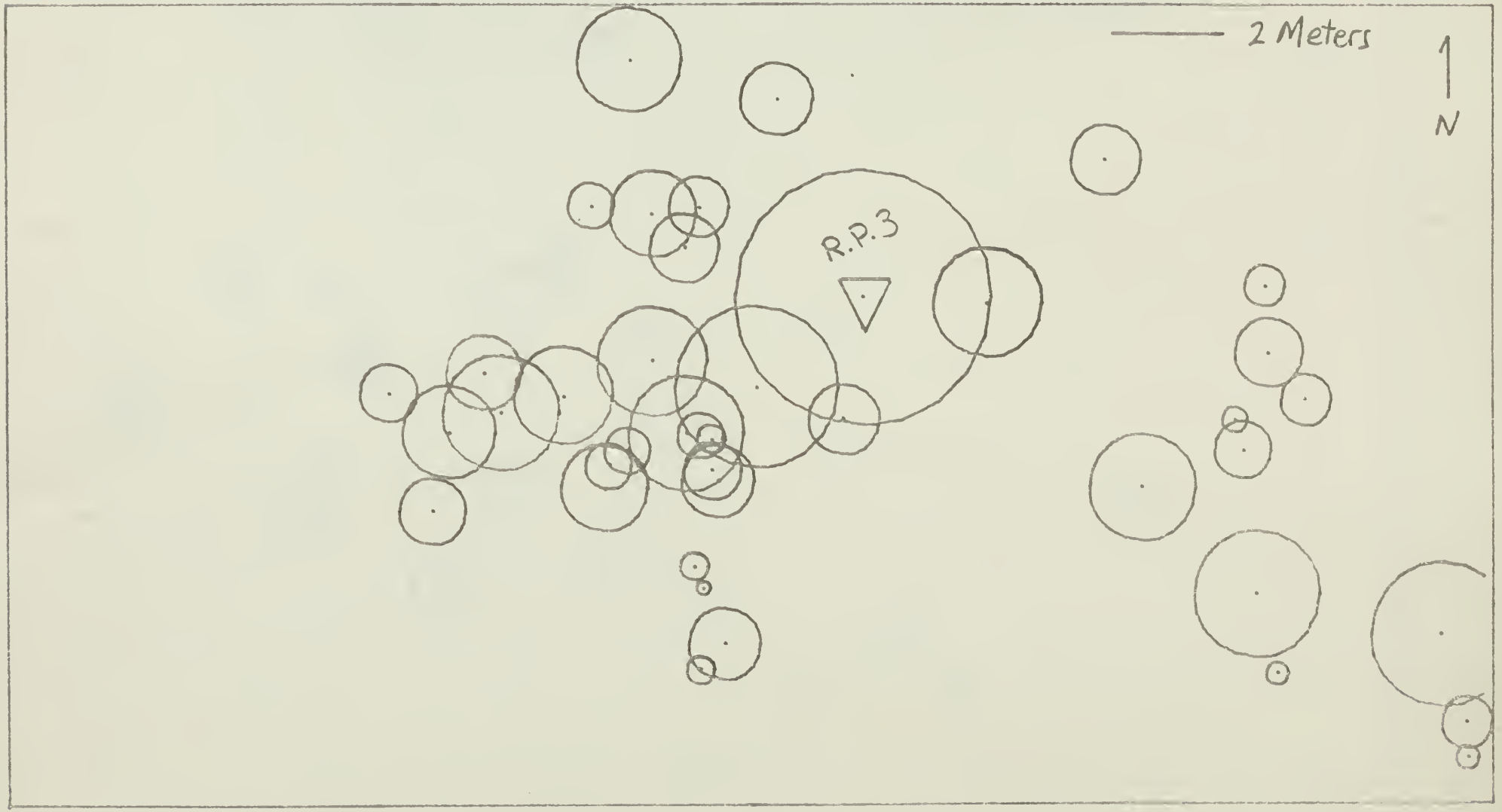
Reference Points 2 and 3
Boundary is 51 x 27.5 Meters



TREE MAP 3A. Mt. Buckley

Enlargement of West-Center portion of TREE MAP 3.

Boundary is 25.5 x 13.75 Meters



TREE MAP 4. Loggy Boundary is 45 x 28 Meters

GRAPHIC INTERPRETATION

The data were graphed in two ways to show the invasion of the areas as the numbers of trees increased (Figure A) and as the spread increased. (Figure B)

The tree number graph indicated the number of trees as their year of germination (at least the year they reached the level at which the core sample was taken). This list is not current because smaller trees were not included lest they be damaged by boring.

The spread graph is based on the total spread, but the extrapolation back in time is based on the spread of trees as they have reached a certain spread at a certain age.

ANDREWS BALD ○SPRUCE-FIR

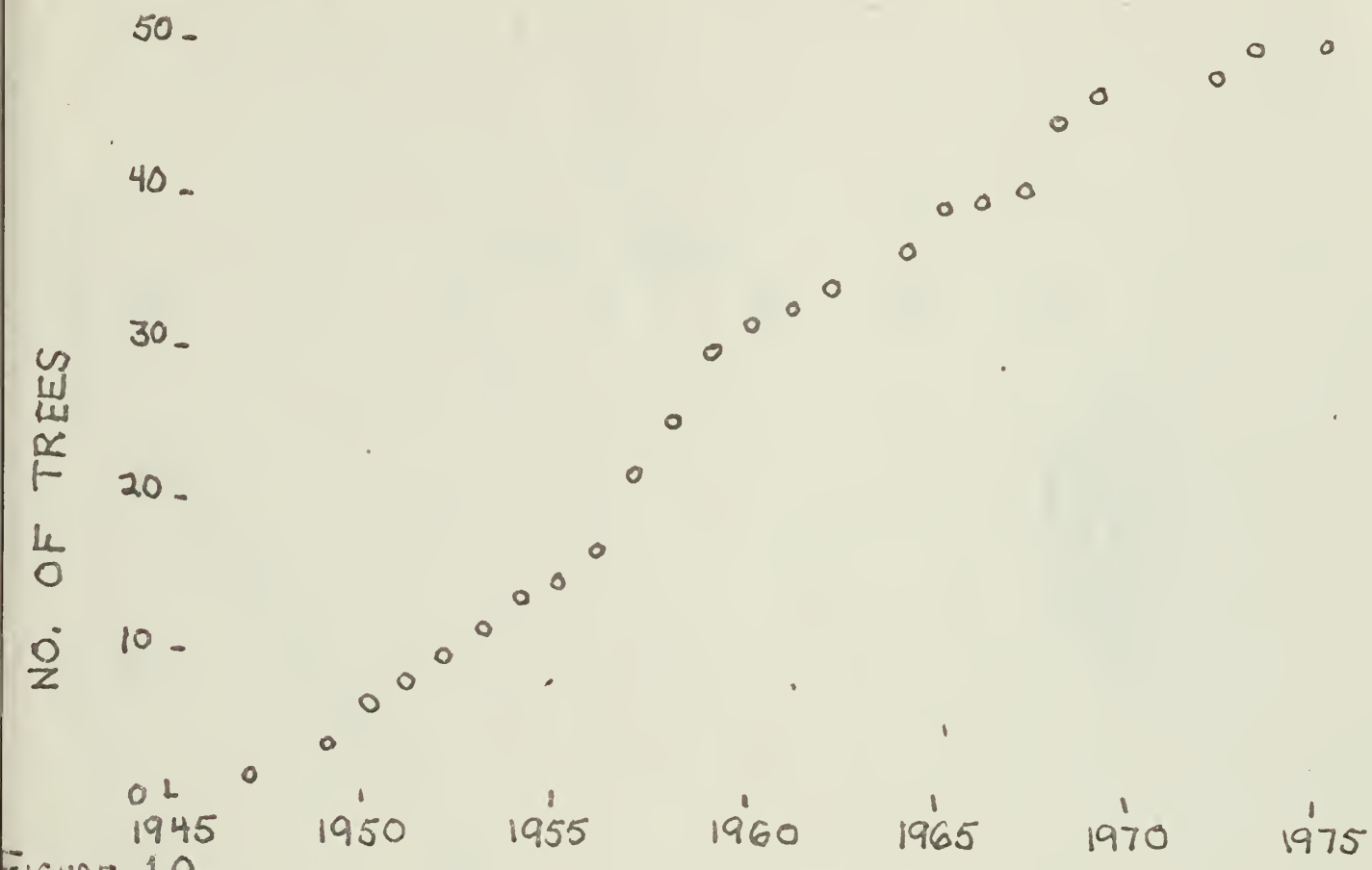
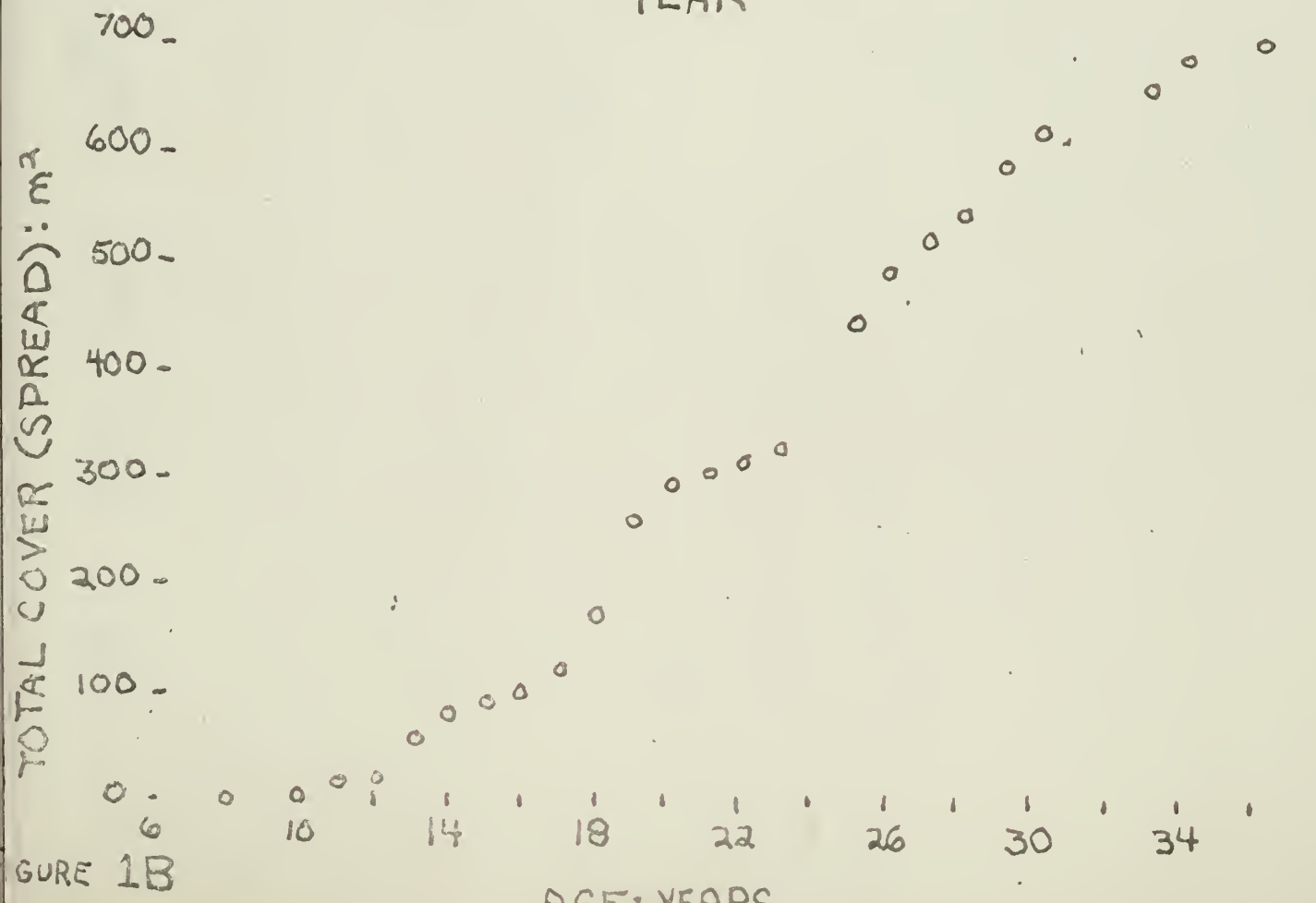


FIGURE 1A



GURE 1B

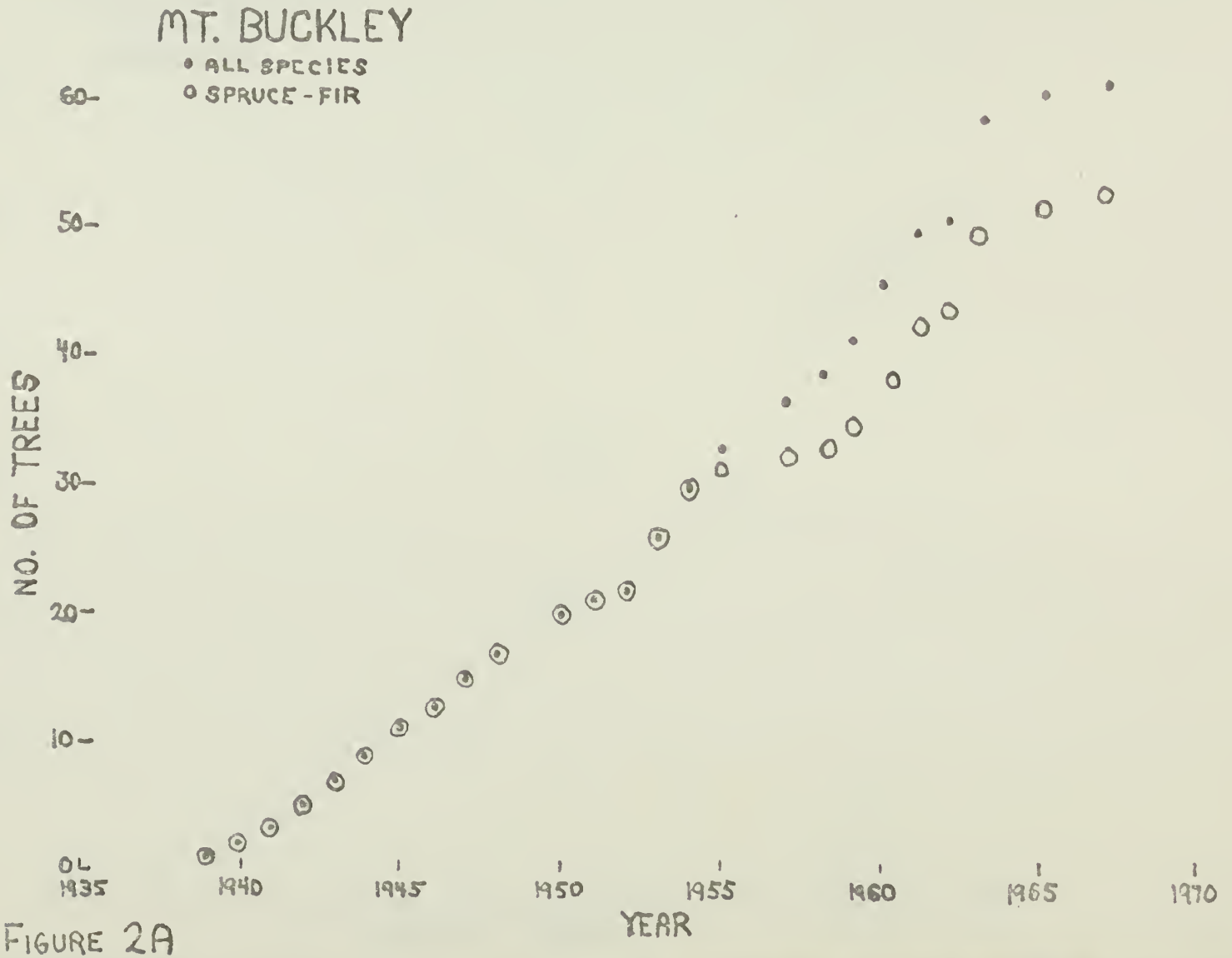

MT. BUCKLEY
• ALL SPECIES
O SPRUCE - FIR
60
50
40
30
20
10
0
1935
1940
1945
1950
1955
1960
1965
1970
NO. OF TREES
YEAR

FIGURE 2A

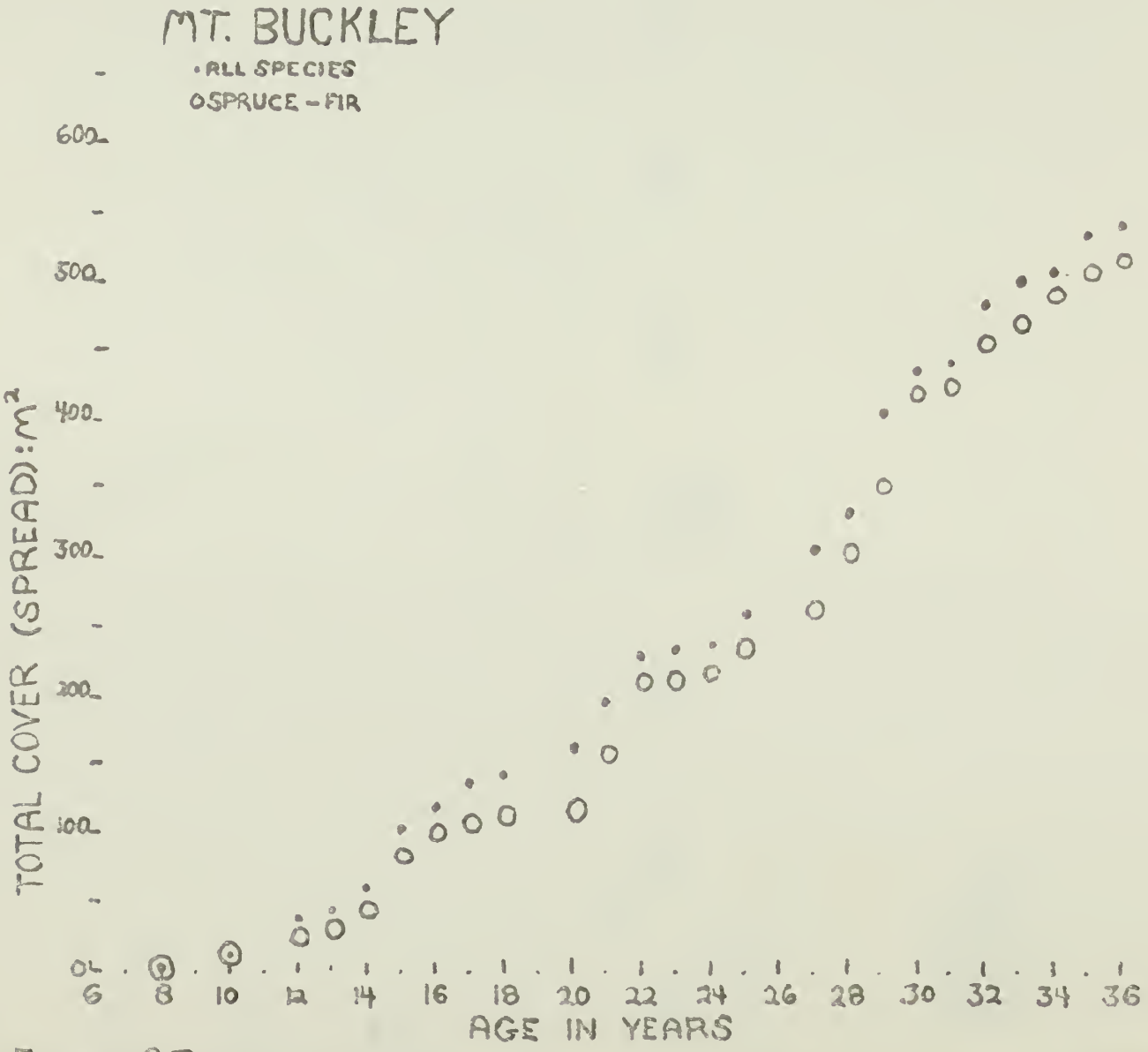

MT. BUCKLEY
•ALL SPECIES
OSPRUCE-FIR
TOTAL COVER (SPREAD): M²
600
500
400
300
200
100
0
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
AGE IN YEARS

FIGURE 2B

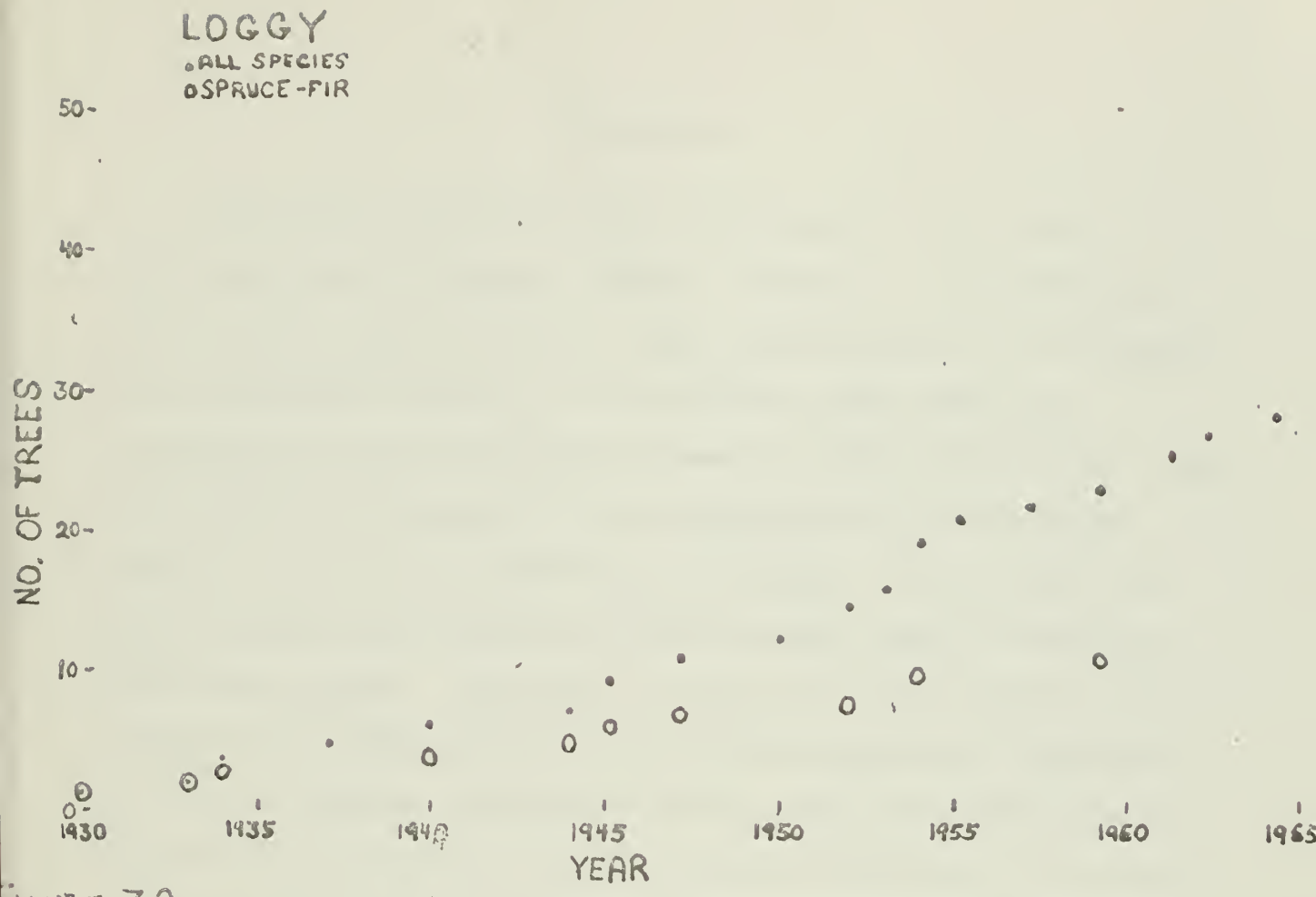
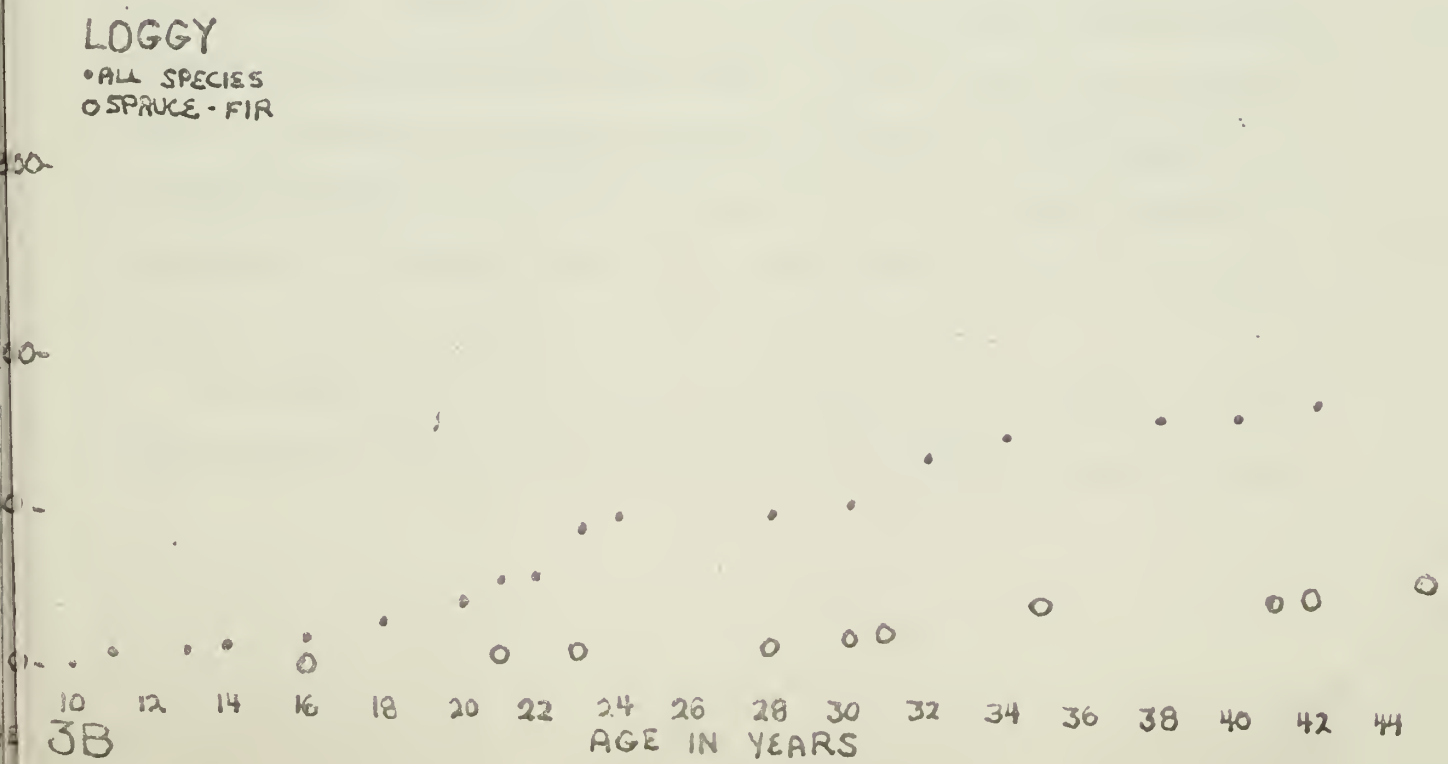

LOGGY
•ALL SPECIES
oSPRUCE-FIR
NO. OF TREES
50
40
30
20
10
0
1930
1935
1940
1945
1950
1955
1960
1965
YEAR

FIGURE 3A


LOGGY
•ALL SPECIES
oSPRUCE-FIR
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
AGE IN YEARS

3B

Discussion

The main natural force for disturbance in the spruce-fir forest of the Smokies is wind. Figure 7. is a photograph of a severe windthrow of the type long prevalent in the Smokies, but especially frequent in the last two years (1974-5). Succession in these disturbed areas is fairly predictable. Some fire cherry will come in on the disturbed soil of upturned roots, but it is the established seedlings of spruce and fir which spring into prominence when released from the shade of the canopy trees. Comparison of the Forney Ridge Parking Area today with a 1934 photograph in the Park Archives illustrates a typical invasion and reforestation. Age data from these and other trees indicates a highly variable growth rate. The variability seems to be a product of the nature of the seedlings present and of the severity and extent of the damage.

The problem of this study centers around the un-natural disturbances. Andrews Bald is of unknown origin, but was maintained by grazing until about 1931. Since then it has undergone an invasion of shrubby species (especially Vaccinium and Rhododendron), but spruce and fir are the most prominent invaders. Mt. Buckely has fire cherry and mountain ash as important invaders since the fire there in 1925.

The invasion is plotted in the section of graphs. A time scale for the completion of invasion is calculated as follows:

			Andrews Bald	Mt. Buckley	Loggy
Effective* plot size-M^2	=	A	8445.	2804.	1260.
Tree cover area-M^2	=	A_1	701.	554.	004.
Age of oldest tree-years	=	G	36.	39.	42.
Invasion rate M^2/yr	=	AT/G	19.47	14.2	4.8
% covered by trees	=	A/AT	8.3	19.7	16.1
% covered per year	=	AT/G/A	0.23	0.5	0.38

* Areas in the computer plot boundaries with unsampled trees were excluded.

This works out to give us about 400-200 years before complete invasion. The times as well as the straight line trends of both graphs are unexpected and unexplained.

It is my opinion that Andrews Bald has reached a point of development in which invasion will reach a higher rate. This is based on the numerous seedlings in the immediate vicinity of existing trees. Since age was a key factor in the present study these seedlings were not included.

This study establishes the fact that Andrews Bald is being invaded. If there is a management decision to maintain Andrews Bald as a grassy bald there must be some human intervention. There is time for experimentation to determine the most feasible method. If Andrews Bald is left to nature it will eventually be reforested. The other disturbed areas require no management

except perhaps a warning to visitors of a fire hazard to recent windthrow damaged areas in especially dry periods.

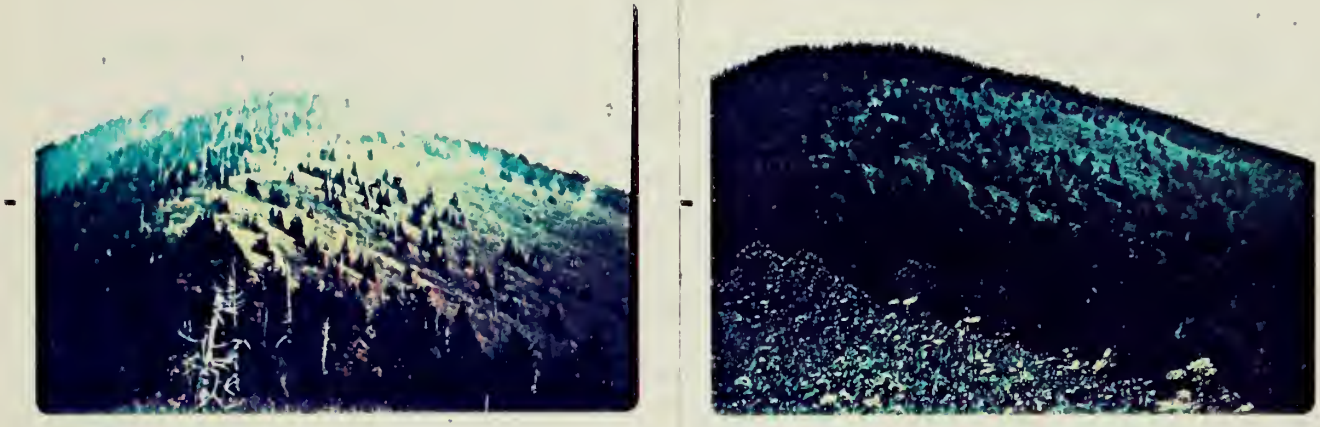
This study provides a clear picture of spruce and fir invasion in three areas in 1975. This base should be of great value as a reference point for future studies.

1962 1975

Fig. 4. Andrews Bald looking south towards Lake Fontana

1964 1975

Fig. 5. Andrews Bald looking south toward Sign Post



1960 1975

Fig. 6. Looking east towards the peak of Mt. Buckley

1975

Fig. 7. Windthrow near Anakeesta Knob

APPENDIX I

At the Association of Southeastern Biologists meeting in New Orleans in April, 1976, I presented a paper which explained the mapping procedure of this study and proposed a theory on the origin of grassy balds. This paper was presented with some modification at the meeting on Scientific Research in the National Parks of the Uplands Areas of the Southeast Region in Gatlinburg in June. The bald origin theory is included here--not so much that it is the answer, but perhaps the perspective is worthwhile.

Radford's thesis in 1968 documents some of the legends and theories of the origin and maintenance of grassy balds in the Smokies. In recent years it has become clear that the balds are being invaded (See Fig. 4 and 5.). The invasion following the removal of domesticated animals in the early 1930's (Campbell, 1960) clearly establishes grazing as a maintenance factor.

West of Mt. Buckley about three miles from Andrews Bald is a situation which may well be parallel to the early history of Andrews Bald. This area was logged in 1923 and burned in 1925 (Campbell, 1960). Although the area is being invaded by spruce and fir (Fig. 4.), there are some large areas which have remained virtually unchanged in twenty years of observation.

Speculation in the origin o· Andrews Bald might start with the area in climax spruce-fir forest.

I propose that the origin of Andrews Bald was the result of the unusual timing of a sequence of natural events starting with a severe windthrow (similar to Fig. 7.). Following the windthrow the debris dried out during an exceptionally dry period. A bolt of lightning could have provided the source of fire to consume the existing vegetation. Following the fire the succession process reached a point of stagnation similar to the present situation at Mt. Buckley. If grazing animals were introduced during this period they could have brought about the grassy community by their destruction of woody species intolerant to grazing or trampling. It would be an interesting experiment to introduce grazing animals to a portion of Mt. Buckley.

APPENDIX II

Correlation graphs.

These two figures are included to show the great degree of variation within the sample.

Figure 8. Correlation of age (based on the more reliable samples--3 & 4) of fir to height.

Figure 9. Correlation of age to spread.

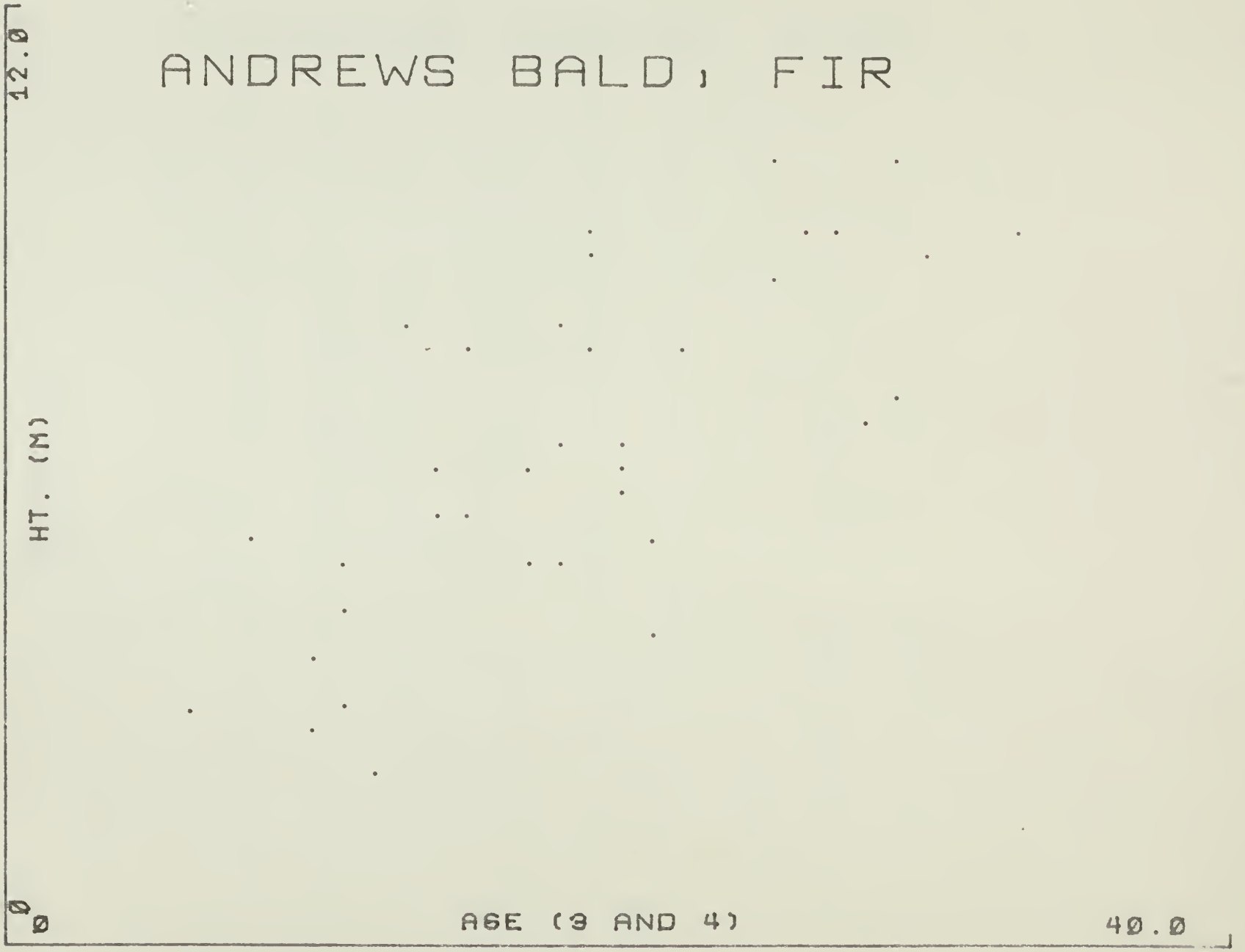


Figure 8. Correlation of age (based on the more reliable samples--3 & 4) of fir to height.

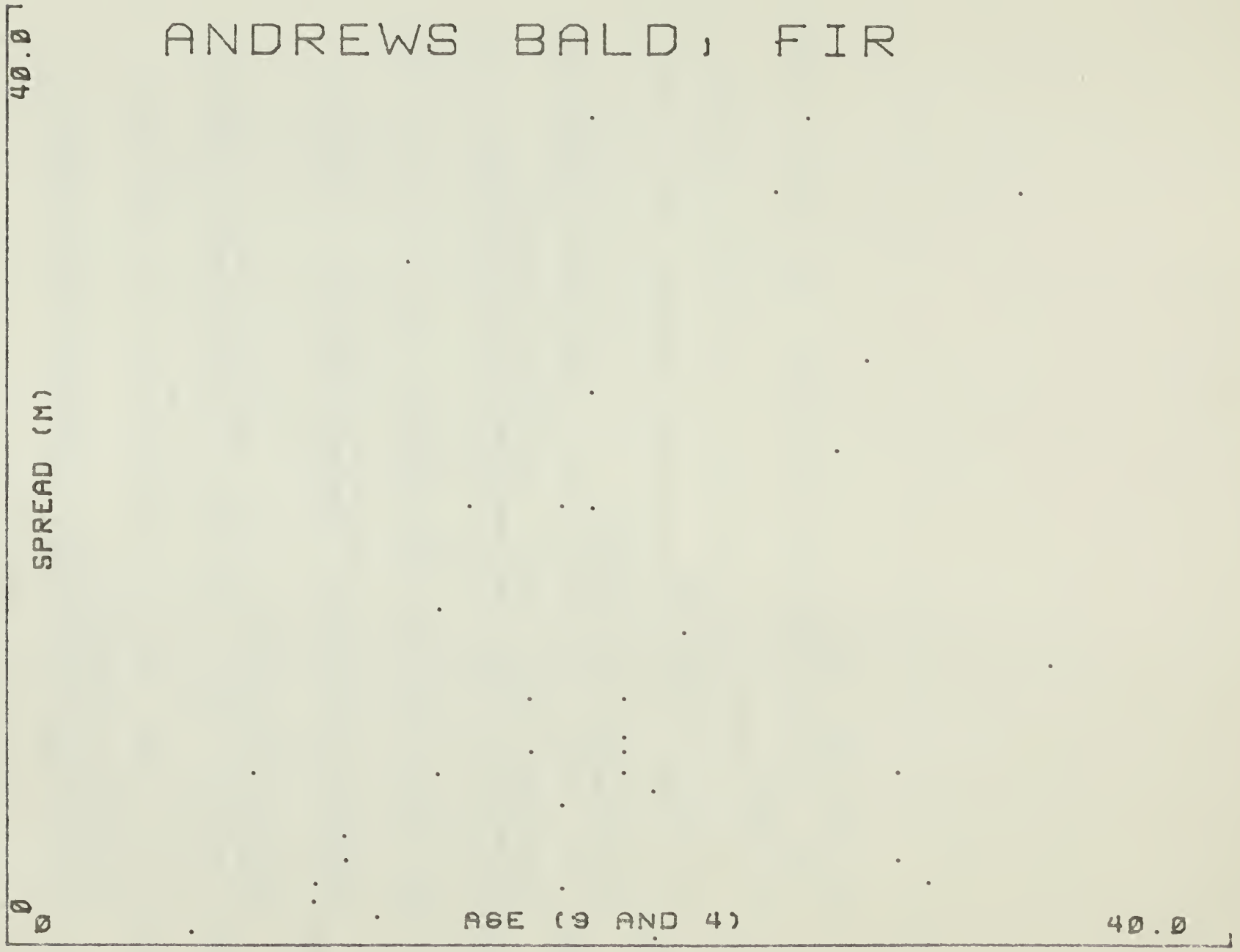


Figure 9. Correlation of age to spread.

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Conclusions and Management Recommendations

The present status of the Spruce-fir Forest Type was examined at three sites: Andrews Bald, Mt. Buckley and Loggy.

The data obtained during this study indicates that the spruce-fir forest type is invading all three areas and will result in the closure of the "balds."

Dr. Ramseur states that a management decision to maintain these sites as open grassy areas will be required. Although no direct recommendations for management procedures were made, the following methods based on present scientific knowledge are suggested as options; the order in which these suggestions are listed does not indicate an order of preference or effectiveness.

1. grazing by domestic animals
2. controlled burning
3. clear cutting

Field studies including these management options are currently being conducted by personnel at the Uplands Field Research Laboratory, Great Smoky Mountains National Park and Cornell University, Ithica, New York.

The original research summarized in this report was conducted by Dr. G. S. Ramseur, Department of Biology, The University of the South, Sewanne, Tennessee 37375, National Park Service, Contract Number: CX500050205.

The report, including all raw data, fullfilling the obligation of this contract is appended.